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ABSTRACT

Miniaturized computer technology can raise both language and education beyond the current capacity to understand. Children's learning is more complex, powerful, and subtle than it is usually given credit for, and language is more elaborate and intricate than is generally realized. Computers must be used carefully, but they offer many possibilities, largely unexplored. They do not necessarily isolate individuals in their learning tasks, but can dissolve the walls of the classroom, collapse space and time, and bring people together in dramatic new ways. Computer capabilities, particularly word processing, provide such options as joint authorship, networking, and long-distance communication and collaboration through cross-cultural letter writing. Teachers must learn to use computers, and take advantage of the creative and interactive potential of computer technology. But they must also decide and assert the way computers will be used in education. (MSE)

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The Promise and Threat of Microcomputers for Language Learners

Frank Smith

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We live in exciting times. The influence of microcomputers is growing rapidly and inexorably in education, and I want to reflect upon the dramatic consequences that could transpire for learners and for language. Computers are incredibly powerful devices, capable, I think, of destroying both literacy and teachers if they are not used intelligently. On the other hand, I also believe that miniaturized computer technology has the potential of raising both language and education to levels beyond our current capacity to understand.

Despite my title and initial usage, for the remainder of this discussion I shall refer simply to *computers* rather than to *microcomputers* or *micros*. Although popular in educational jargon, the term *microcomputer* is unwieldy and also technically incorrect (the *microcomputer* is the tiny operating chip at the heart of the device). My subject is the class of small computers known in the trade and advertising brochures as *home*, *personal*, or *desk-top*, costing about $2000 or less, and in particular with their *word processing* functions.

These are weighty issues, and I shall build to them gradually. First I shall consider learners and language, and then computers. This is the order that I think everyone in language education should respect. I am not in the least interested in manipulating either learners or language to fit the demands of computers. But I am most interested in using computers in the service of learners and language. Therefore, I do not propose to talk about computers until the very end of this presentation. Instead I shall devote most of my time to considering once again the nature of learning and of language. Children's learning is much more complex, powerful and subtle than they are usually given credit for, especially in education, and the consequences of failure to recognize the true nature of learning will become enormously dangerous with the deployment of computers for instruction. And language itself is much more elaborate and intricate than is generally realized, which

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again can lead to great hazards if computers are indiscriminately used for teaching about language.

THE COMPLEXITY OF SPOKEN LANGUAGE

Both the amount and complexity of the spoken language learned by children during the first few years of their lives are underestimated. Language learning is belittled and distorted by the common assumption that it essentially involves the development of vocabulary and grammar. There is much more to language learning than vocabulary and grammar; if these are all you have then you are most unlikely to understand or to be understood in any language. But even the amount of vocabulary and grammar learned by young language users is grossly underrated.

Vocabulary

Most people do not know the size of their own vocabulary. They know how tall they are, and their shoe size, and even sometimes a number supposed to be a measure of their intelligence, but they are ignorant of something as fundamental as the size of the pool of words upon which they can draw in support of every human transaction. So I shall tell you how to make a very quick and reliable estimate of the size of your vocabulary. Take the biggest dictionary you can find—the bigger the dictionary, the bigger your vocabulary will be—and randomly select a representative sample of 100 words on which to test yourself. The easiest way to select such a sample is to divide the number of pages in the dictionary by 100 and to look at one word on each of the resultant number of pages. If the dictionary has 800 pages, for example, 800 divided by 100 equals 8, so you look at one word on page 8, another on page 16, on page 24, and so on. The particular word you look at on each page doesn't matter provided you do not know what it will be, so select a convenient one in advance, like the first on the page (which many dictionaries also print in the top margin). As you look at each of the 100 words, simply ask yourself if it is familiar. Don't worry about whether you can give the dictionary definition—knowing the definition doesn't prove that you can use or understand the word, and not knowing the definition doesn't mean that you can't. Ask whether you would be likely to understand the word if you met it in context, in a sentence that you read or heard, without having to ask someone about it or to consult a dictionary. If the word is sufficiently recognizable, credit yourself with knowing it. Count up the number of words that you know out of the 100, and you can say that you know that percentage of words in the dictionary. If the dictionary contains 120,000 words (most dictionaries tell you at the beginning how many words they contain), and you recognize 75 of the 100 sample words, then you can assume you know about 75 per cent of the 120,000 words in that dictionary, which equals a vocabulary of 90,000 words.

How many words does the *average person* know? Estimates vary widely, partly because of the difficulty of defining exactly what constitutes a word. I have seen estimates of 100,000, 150,000 and even 250,000 words for an average young adult's vocabulary. The most conservative estimate I have ever seen, for high school leavers, is 50,000. Consider just that one number for a moment—50,000 words, learned in the first 18 years or so of life. Do a little mental arithmetic. It works out to an average of about 2700 words a year. How does anyone manage to acquire that kind of vocabulary, at that rate?

Mary Smith (1941)—no relation of mine—asked that question of seven and eight-year-old schoolchildren in California over forty years ago. I still cannot understand why her results are not better known among language teachers. She estimated the vocabulary size of a group of seven-year-olds, and also the vocabulary of a group of eight-year-olds, using the technique I have just described. She subtracted the first figure from the second and reasoned that the result represented the number of words the seven-year-olds would be likely to learn during their eighth year of life. She then divided that number by 365 and the result was—29. Those children were adding an estimated 29 new words to their vocabularies every day of their lives—including Saturdays, Sundays and holidays. And Mary Smith made no allowance for forgetting or inattendance. Presumably a child who spent all of one day in bed had to learn 58 new words the next.

Many teachers do not believe the result of Mary Smith's study. They say it is impossible. They say that it takes an hour to teach a child a list of ten words, and they are lucky if the child remembers five of them the next day and two by the end of the week. When could children learn 29 new words a day? I suppose part of the answer must be when they are not working on the word list.

Miller (1977) was also suspicious of such a result. He had exactly the same kind of estimates made with a group of four-year-old children in an experimental school in New York. And the conclusion of this study was that the four-year-olds were adding words to their vocabulary at the rate of 20 a day. Miller calculated that they had in fact been learning at the average rate of one word for every hour they had been awake since birth. Who taught them?

Even these numbers minimize the amount of vocabulary learning that children routinely achieve. There is an odd idea around that for a word to be learned, its sound—its *name*, if you like—such as *table* or *chair*, has to be associated or connected in some way with its meaning. But there are no *meanings* floating around in the world, waiting to have the sounds of words attached to them. Words do not have unique and discrete meanings, except in the conventional *definitions* of concise dictionaries and schoolbooks. Words instead have complex rules of application, varying according to many linguistic and situational factors. The most common words of any language have a multiplicity of senses and even of grammatical function. Check how much space is taken up in English dictionaries to *define* everyday words like *time, run, house*, or *empty*. If you know 50,000 words then you know 500,000 possible meanings of those words, or 5,000,000, or an infinity. When did you learn them all?

Grammar

I do not have the space to talk about grammar, except to say that the grammars every child knows are far more complex than the children or the grammars are ever given credit for. I am not talking about the traditional structural grammar taught in classrooms, which causes so many otherwise competent language users so much difficulty and which never helped anyone to say anything or to understand anything. This is a post mortem grammar, useful only for the dissection of language lying dead on a page. I am referring instead to the grammars that children need to use to make sense of the language they hear around them, and to be understood themselves. These are the grammars that linguists sometimes refer to as *generative*

and *transformational*—the functional systems of dynamic interconnections between language and thought in the human brain.

Even infants just beginning to talk employ such functional grammars because words are never put together randomly. The language we produce always follows *rules* of implicit internal grammars, even though these grammars themselves vary among groups of individuals as part of the characteristic ways in which the groups use language among themselves. To be understood and to understand, we must know and respect the grammars of the people with whom we communicate. For this reason I consistently refer to *grammars* in the plural. A functioning language user must master more than one grammar. Even if the grammars of individuals within a group vary only slightly, both those variations and the appropriateness of their use on particular occasions must be understood. A child who can understand the language of a particular television character shares a knowledge of that character's grammar.

And these grammars are of a complexity that defies linguistic analysis. No researcher has ever attempted to delineate anything like a full set of the language rules that even a child of two commands. Intricate theories are required to describe only small parts of a child's total functioning grammar, such as the negative or interrogative. Linguists who attempt to hypothesize the systems underlying adult language produce recondite arguments running to hundreds of pages, incomprehensible to the lay person, containing diagrams of nodes and interconnections rivalled in complexity only by anatomical illustrations of the neurological networks of the brain itself. How could such grammars be taught to children? Most people do not even suspect that they exist. When and how could they be learned?

Cohesion, Idiom and Register

The vocabulary and grammar employed by individual language users may be more extensive and complex than is generally realized, but they would still be far from adequate in themselves to constitute an effective functioning spoken language. Mastery of at least three additional language systems is required, the systems of cohesion, idiom and register.

Just as sentences are not composed of just one word after another, randomly organized, so extended utterances or texts are not just sequences of sentences randomly juxtaposed. Grammar determines how words should be arranged in sentences, but grammar ends at the sentence boundary. A different system organizes sequences of sentences, a system that is called cohesion. Every sentence contains cohesive markers that lock it into the sentences around it. To change the order of sentences in meaningful discourse, the sentences themselves must be changed. I can say "the book is in the car. I'll get it." but not "I'll get it. The book is in the car." I would have to change the sentences themselves to something like "I'll get the book. It's in the car." Halliday and Hasan (1976) say that cohesion is what puts the texture into text. Their endeavor to outline the different kinds of linguistic device that lock sentences together cohesively runs to over 350 pages. Such is the complexity of a system that few people suspect exists, yet that all children learn with respect to the groups whose language they share.

Then there is idiom, the minefield of language learning as far as I am concerned. My bookshelves are littered with the tombstones of teach-yourself books for the many languages I have attempted to learn in the past. In every volume I have worked

my way diligently through the first eighteen chapters, memorizing all the vocabulary items and achieving eight out of ten on every grammar test, until I was sure I had the language beaten. And then I was hit by chapter nineteen, the chapter headed *Idiom*, and suddenly realized that I did not know the language at all. The actual examples of language in use in that chapter—the extracts from novels, newspapers, correspondence and conversations—were nothing like the fabricated *examples* of the first eighteen chapters. By definition, idiom is the way the language is used. To know a language you must know its idiom. But by definition also, idiom is what vocabulary and grammar will not predict. And the scope of idiom is enormous, far more than could ever be covered in chapter nineteen. The Oxford Advanced Learner's Dictionary of Current English lists 75,000 *illustrative phrases* and 11,000 idiomatic expressions. The Oxford Dictionary of Idiomatic English contains 20,000 items. Neither volume is truly current because idiom is the living edge of language and constantly changing. How did you learn all of this in your childhood and youth?

Yet even with cohesion and idiom on top of vocabulary and grammar, you do not qualify as a competent language user. Again as every child knows, although linguists have only relatively recently begun to understand it, the language we speak must vary from occasion to occasion according to register. And register depends upon three critical factors, the topic under discussion (you do not discuss a death in the family in the same way as a shortfall in the coffee fund or the staff picnic), whom you are talking to (four-year-old children talk differently to six-year-olds and to two-year-olds, to children and adults, strangers and friends, parents and teachers), and the circumstances in which you talk (you do not address your aunt in the same way face to face, by mail or over the telephone).

And still I have not considered all of the language learning that children engage in and largely master during the first few years of their lives. I could expatiate on how much children learn of intonation, gesture, and other complicated but nonverbal aspects of language. But I hope I have made my point. The amount of language learning accomplished by children is enormous, and it is all done without formal instruction, deliberate application, programs, drills, exercises, marks, tests, scores, conscious feedback or diagnosis.

The Conventionality of Language

Every aspect of language that I have discussed—every one of those thousands of words and idioms, hundreds of grammatical devices and all of the nuances of register—could be different. They are all conventions, reached by historical accident and tacit agreement. None of them is especially logical or necessary; in other languages everything done in our language is done differently. What this says to me is that learning a working knowledge of any language is an enormous intellectual feat. The particular language that you speak is not a genetic gift, part of your biological inheritance, nor could you have worked it out by logic or reason. Every bit of language has to be learned.

Children do not learn to speak the language of their parents unless they are brought up in the language community of their parents. A child brought up in a Chinese speaking environment learns to speak Chinese. The same child raised in a Swahili culture would learn Swahili. Surrounded by English speakers, the child would learn English, and later in life find Chinese or Swahili difficult if not impossible. There are over three thousand different *natural* languages in the world,

and every child who is born is capable of learning any of them, and will of course learn the one that happens to be around. In fact, no one would suggest that the languages we have in the world at this moment constitute a full set, that there could not be others. Languages were different hundreds of years ago, and will be different hundreds of years from now. That means that every child who is born is capable of learning languages which do not yet exist. The thought makes me shiver.

I marvel even more at the thought that every baby is capable of learning to make sense of the culture, the society, into which he or she is born. I do not know how many different cultures and societies there are in the world, or even how one might categorize and count them, but there must be many thousands more than there are languages. Their variety is enormous. Yet once again, children's rapid understanding of the customs and relationships of the community of which they are part is not born in them, it is not a biological predisposition. All children are capable of making sense of the world in which they find themselves—at least until they get to school. But the worlds we have today, in all their variety, are different from those of former times and from those of the future. That means that children are born capable of making sense of worlds that do not yet exist.

THE LEARNING BRAIN

How then is all of this learning about language and about the world accomplished by children? Part of the answer must be that learning takes place continuously. Learning is not the occasional, sporadic, almost reluctant activity it is often taken to be in schools, requiring specially organized instructional sequences, incentives, feedback, reinforcement, monitoring and testing. Rather learning must be a constant condition of the brain, its natural occupation, as continual, effortless and unconscious as breathing normally is for the lungs. Lungs are not organs which occasionally, under appropriate circumstances, can be induced to breathe. By definition, lungs breathe; lungs that are not breathing are something else, like dead lungs. Children do not normally have to be taught to breathe. They are equipped with a potent device that makes not breathing aversive, namely suffocation. That is why we do not have to drill children in anti-suffocation skills in school. By definition also, brains learn. Brains which are not learning are something else, anaesthetized brains perhaps. Every child is equipped with a device as potent as suffocation that makes not-learning aversive. That device is boredom. A condition of boredom means only two things, either that we know something already or that we see no point in learning something. In either case, boredom means that learning is not occurring, and boredom is intolerable, especially for children.

Children may not learn what we think we teach them in the classroom, but we may not be teaching what we think we teach in the classroom. We may be teaching that learning is boring, painful, ritualistic and discriminatory, and that may be what children are learning. The fact that children may be learning all the time is a time bomb in every classroom. They may learn not from what we preach but from what we practise. They may be learning what we really feel about reading, writing, education and children.

How is children's first command of spoken language achieved? Not because their parents instruct them in any explicit sense. Parents have neither the time nor the expertise even to begin consciously to inform their children about the nature of their own vocabulary, grammar, cohesion, idiom and so forth. Nor, for that matter, do

teachers or linguists. Children learn about language by direct involvement in language use. They join a language community as junior members—"spontaneous apprentices," as Miller (1977) aptly says—and learn because other people help them use language and take it for granted that they will learn themselves. If a child does not understand what someone else says, the circumstances in which the speech occurs is likely to indicate what it means—"Pass the salt, please"—and learning can take place. If circumstances do not explicate then an adult probably will. When a child tries to say something, adults or peers help the child to say it properly. Not that a great deal of spoken language can be learned from one's own speech—children just do not say enough to learn by trial and error. What speaking does is admit children to a community of spoken language users, where they can hear and learn vicariously from people who talk the way it is taken for granted they will learn to talk themselves.

There is exquisite selectivity. Children first begin talking like their parents, then like their peers, and later perhaps like their favorite entertainment or sporting personalities. They do not learn to talk like everyone they hear speaking, even those they may hear most. They learn the language of the groups to which they belong (or want to belong), and resist the language of the groups that they reject or from which they are rejected. They learn, I want to say, from the clubs to which they belong.

This pervasive and continual learning extends far beyond the structures and conventions of language to mannerisms, dress, ornamentation and all other patterns of behavior in general. It takes place in the absence of overt motivation or deliberate intention (as we all know when we come away from a film or a book acting the part of one of the characters). *Engagement* is the term I have used to characterize such learning (Smith, 1981a). It is not learning that takes place as a consequence of someone else doing something, but rather learning that occurs concurrently with the original act—provided that we make it our act too. The other person's behavior is our own learning trial. We learn when the other person does something on our behalf, something we would like to do, which we take for granted—if we think about it at all—that we will be able to do. It is the kind of thing people like us do. We are members of the club.

There are seven characteristics of these learning situations that warrant attention. The learning is (1) meaningful, (2) unconscious, (3) effortless, (4) incidental, (5) vicarious, (6) collaborative, and (7) free from risk. The learning is meaningful because there is always an apparent purpose, the behavior is done for a reason which the learner understands and can share. The learning is incidental (and unconscious and effortless) because accomplishment of the purpose, not learning, is the learner's objective. (I call this the "Can I have another donut?" theory of language learning. Every child learns to say "Can I have another donut?", not in order to learn how to make such a statement but to get another donut. In the process of trying to get the donut, the child incidentally learns how the request is uttered.) The learning is vicarious and collaborative because someone else does what the learner learns, and for the same reason it is free from risk. There are no tests and no grades.

Adults learn continually in the same way—though most of us have come to regard learning as such an effortful process that we are inclined to overlook such learning on our own part or to regard it as something different (perhaps as *memory*). For example, with a little bit of mood setting we can all recapitulate the most interesting contents and much of the layout of the last newspaper, magazine and novel that we read, we can describe what we had for lunch yesterday and the day before, what

our friends wore, and what we saw on television or at the movies. With scarcely more than a glance we can recognize movies we last saw years ago. Indeed, the only thing likely to interfere with our recollection of an event in which we are personally involved is the deliberate decision beforehand to try to memorize what we are about to experience.

If learning can be so effortless and continual, why does it frequently seem so difficult? Four reasons can this time be enumerated. The first is that learning does not take place if we do not understand what we are hoping to learn. What could there be to learn? The second cause of learning failure is memory overload. The effort to memorize destroys comprehension and thus makes learning difficult and pointless. The third reason is absence of utility. We do not easily learn something for which we see no purpose. And the fourth reason is expectation that learning will not take place in any case. This I believe is the cause of so much adult difficulty in mastering particular subjects (like statistics, foreign languages or reading music, for example) despite enormous outlays of time and effort, and why it is tragic that so many children are tested to prove that learning will be difficult for them. Learning occurs only if we preceive ourselves as members of the appropriate club. If we exclude ourselves or if exclusion is imposed upon us, then the brain simply shuts down as far as the particular learning is concerned. This is not the kind of person we are, and there is no possibility of vacarious engagement.

READING AND WRITING

Similar problems of mastering huge numbers of conventions confront children learning to read and to write. Written language is not just speech written down; there is a whole new range of registers to be learned in order to understand and produce different kinds of text. Once again the task is grossly underestimated. Writing is often seen simply as a matter of learning handwriting, spelling and punctuation. Writing is much more than these, but the scope and scale of even these *basics* is generally unsuspected by teachers and learners alike. Spelling, for example, demands the memorization of every word we are ever likely to write (Smith, 1981). The *rules* of spelling are numbered in the hundreds and still carry only a fifty percent probability of being correct for any particular word. There are so many alternatives and exceptions that we must confirm and memorize the correct spelling of every word we hope to write with confidence in the future, even if it does happen to be *regular*. When does anyone check the spelling of all the words that are routinely spelled correctly, let alone commit them to memory?

Punctuation, capitalization and other *rules* of grammar are essentially circular and meaningless to anyone who cannot already do what is supposed to be explained. Children are instructed to begin sentences with a capital letter and to end them with a period, but if they ask what a sentence is they will sooner or later be told that it is something that begins with a capital letter and ends with a period. The statement that a sentence is a *complete thought* is as inaccurate and empty as the assertion that a word is a *unit of meaning* or that a paragraph is organized around a single topic. How could anyone recognize a unit of meaning, a complete thought or a topic in isolation? Linguists are unable to make any constructive use of such statements, which are definitions, not rules of application. They are meaningless to anyone without an implicit understanding of the conventions that determine what constitutes a word, sentence or paragraph, conventions which differ from one

language to another. Unfortunately, those in possession of such implicit understanding tend to find the definitions transparently obvious and to regard them as the basis of learning rather than the consequence of having learned. Obviously anyone who can write must have knowledge of these conventions, but this knowledge cannot be made explicit and taught to others.

Even arbitrary *rules*, descriptions and definitions evade us when it comes to such subtle considerations as style, the intricate registers that written language itself demands in different circumstances, and the *schemes* appropriate to the particular medium being employed. Once again, trial and error cannot account for what writers know. No one could write enough and get sufficient feedback to discover even a fraction of all the relevant conventions. The only place all the demonstrations are available is in the text produced by others. I have argued that children must learn to write by reading like writers—they must use authors as unwitting collaborators (Smith, 1983).

In Britain, Margaret Spencer has been developing the idea that children are taught to read by authors. She is elucidating the mystery, often stated but rarely explored, that children learn to read by reading. Her view is that authors of the stories children most like to read understand best what children must know in order to learn to read, and that children acquire this knowledge in the process of reading these stories (or having them read to them).

Once again, for reading and for writing, the learning principles I have outlined can be seen to apply. Children learn by being accepted and by accepting themselves as members of the club of written language users. When children see themselves as poets they read poetry like poets, the vicarious engagement can take place, and they learn to write like poets. They read children's stories like writers of children's stories when they join the club of children's story writers. Of course, until children can write for themselves they need help in joining the club, just as they needed help when first they joined the club of talkers. The language teacher's primary responsibility must be to help children join the appropriate clubs. This is difficult, of course, for teachers who cannot write poetry or stories, who are not members of the clubs themselves. The easiest and most productive way for teachers to induct themselves into these clubs is to write with children. Teachers themselves will then find they are reading poetry and stories differently, reading like authors, and they will be better able to facilitate learning by children at the same time that they are learning themselves.

All of this is the ideal and—I would argue—the only way to learn to become literate. Consider again the seven aspects of spoken language learning situations which I enumerated earlier; they all apply in these reading and writing situations. What is being learned always has sense and meaning to a child; the reading and writing are for a purpose, not an exercise. The learning is unconscious and effortless, no one at the time would know that it was actually taking place. The learning is incidental, the child is reading and writing for the sake of the reading and writing, not for the sake of learning. The learning is vicarious and collaborative, with the author being employed actively as guide and source of knowledge. And there is no risk—there are no exercises, marks, tests, scores or grades.

SCHOOLS

Of course, schools are nothing like this. There is very little meaningful purposeful engagement in either spoken or written language, whether in the tasks

and exercises, in the exchanges between teacher and children or among children in class themselves. Almost all of the language, spoken and written, is employed for school purposes, and it has very little resemblance to the language of the world outside (Cazden, 1972). School purposes are so pervasive that many teachers cannot separate reading and writing from drills and tests. If asked to describe reading and writing such teachers (and often students and parents too) will simply list classroom activities. (In the same way, many teachers and students cannot imagine an educational world without constant tests and evaluations, although these also are not part of meaningful language learning and use in the world outside school). Such teachers have forgotten what written language is really for. Here is a short and incomplete list which might help them.

Written language is for stories to be read, books to be published, poems to be recited, plays to be acted, songs to be sung, newspapers to be shared, letters to be mailed, jokes to be told, notes to be passed, cards to be sent, cartons to be labelled, instructions to be followed, designs to be made, recipes to be cooked, messages to be exchanged, programs to be organized, excursions to be planned, catalogs to be compared, entertainment guides to be consulted, memos to be circulated, announcements to be posted, bills to be collected, posters to be displayed, cribs to be hidden and diaries to be concealed. Written language is for ideas, action, reflection and experience. It is not for having your ignorance exposed, your sensitivity destroyed or your ability assessed. There would not be enough time in the school day for even half of these enterprises to be engaged in even if all the other *programmed* activities of drills, exercises and tests (Smith, 1981a) were eliminated.

Why then are all these other activities so pervasive, taking up so much time and concentration that they may leave little place for more meaningful activities? Again there are several reasons. First, there is an egregious fallacy that if the various skills possessed by practitioners of a particular art or craft can be described and taught to a learner, then a new practitioner will be created. This is the underlying argument (and fallacy) beneath much of the emphasis on *basics* in education today, not recognizing that all of the skills in phonics, word recognition, spelling, punctuation, grammar and so forth are a consequence of being a reader and writer, not a cause. This view mistakes what is learned with the circumstances under which learning takes place, and in particular ignores all of the sense and purpose that permeated the practitioner's original learning. There is also the fact that schools are institutions, and as such have their own imperatives. They are—and to some extent must be—concerned with their own smooth running and perpetuation. Through inertia and for administrative convenience they establish their own procedures and constraints. It is not always easy to establish meaningful written language enterprises when constraints of age and ability groupings, the timetable, the curriculum, classroom walls and the sanctity of the corridors must first be respected. But finally and most importantly, the programmatic grade and test-oriented drills and activities to which I refer are imposed upon teachers and students alike for reasons of control (Smith, 1981b).

The Nature of Programs

Programs come in a variety of guises. They include basal readers and other sets of instructional materials, activity kits, worksheets, most tasks with questions at the end, anything in which specified individual items of learning are expected to be

monitored and graded. Programs can usually be identified from their systematic format, continuous progress, goal orientation, right and wrong *answers*, tests and scores, all designed to ensure that predetermined elements of learning are continually made manifest. A program exists whenever a person outside the classroom decides what a teacher shall do next, even though the program designer can see neither the teacher nor the child involved in the learning situation. Programs are extensively employed in contemporary education and becoming more so. They have come to dominate most classrooms.

The presumption of people who believe that language learning can be simplified by breaking it down into isolated and compartmentalized particles is awesome. It is like believing that an infant could learn about the visual world by being enclosed in a darkened room with just a one-inch wide chink in the drapes, past which preselected objects are paraded. "Watch out, junior, here comes a dog. Ready for another? In a minute I'll show you a cat. You'd better memorize them because the class is moving on to cows and horses tomorrow."

Programs decontextualize and fragment learning. Their only sense is in terms of their own instructional sequences and objectives. Consider any programmatic learning activity from the point of view of the seven characteristics of natural learning situations I earlier analyzed. There is no evident meaning or extrinsic purpose, the learning must be conscious and deliberate, it is rarely effortless, cannot be incidental or vicarious, collaboration is frowned upon if not prohibited, and risk is always present. There is always a personal *grade*.

Despite the importance attached to them and the millions of dollars expended on their development and testing, instructional programs related to reading and writing have never been shown to succeed except in relation to each other or to their own limited goals. Not even the most enthusiastic program developers and apologists would claim that children—especially those most in need—are reading and writing better today than they were at the time of Sputnik, when the systems orientation to education began to seize North America and to spread across the world through missionary zeal, commercial enterprise and ideological contagion. The promise is always of pie in the sky. Failure is never attributed to basic conceptual flaws, but to teachers and to children who fail to respond properly to the programs or who insist on circumventing them. The solution is always seen in terms of more programs, of more stringent goals, objectives and activities that are proof against tampering by children and teachers. A generation of teachers has been trained to be dependent upon programs. Some are even persuaded that programs make teaching easier. In any case, programs are continuing to take up more and more of class time, restricting even more the possibilities of meaningful language enterprises. And teachers themselves are evaluated on the basis of what the programs teach best (Smith, 1981b). I am not talking about *programs* that teachers themselves produce, their agendas for the day or week or year. I am talking about procedures deliberately designed to relieve teachers of the necessity of making critical educational decisions if they don't want to and of the possibility of making them if they do.

Programs are vehicles of external control. They exist because many influential and even well-meaning people believe that there are outside experts who know better than the teacher in the classroom what that teacher should do. In other words, this is a political matter. It is no coincidence that programmatic considerations gain prominence when educational issues become overtly political—when there is a

heightened public emphasis on accountability, on the demonstration of tangible results, however trivial. It is no coincidence that programs and tests go together. Both are concerned with performance rather than learning. Both function by breaking complex activities down into small and sterile units which can be administered separately, tested and counted. Neither is concerned with what cannot be measured, such as love of reading, interest in writing, willingness to attach oneself to practitioners, eagerness to put oneself into learning situations, to engage in purposeful activities—all of those meaningful possibilities to which I have been referring as membership of the club. Language programs not only exclude many children from clubs with their high and irrelevant admission requirements, they frequently conceal that such clubs actually exist.

THE CHALLENGE OF THE COMPUTER

Now I feel I have set the stage for consideration of computers. The issue is not whether we want computers in classrooms or how strongly we might feel emotionally that they can never take the place of teachers. The tide is already seeping under the doors and climbing up the walls. The question is how computers are to be employed and what the consequences will be. More specifically, it is whether computers are to be used by teachers and children, or whether computers will use them. It is the question of control.

Computers are cheaper than teachers—the equivalent of one teacher's annual salary can equip three classrooms for five years. And many influential people, including computer programmers, software developers, and assorted influential politicians and administrators, assert they are more efficient than teachers. And so they are—for teaching programs. If that is how computers are to be used, they will take the place of teachers and eradicate literacy.

Computers can be the ultimate program dispensing machines, incredibly potent and vastly appealing to those who believe instruction can be delivered to students as a commodity. Yet many teachers do not know what a computer is. They would not know what to do with one if it was put into their classroom tomorrow, and would be at the mercy of whatever programs of instruction were available. In fact they would look for programs, for software to relieve them of their anxiety. Basically, computers are power and efficiency—they can extend the human mind, just as the telephone extends the voice and ears and the telescope extends vision. Computers will do for thought and language what the automobile has done for legs, the jet plane for jumping. No-one can catalog what all this will be. What anyone today knows about the potential of computers in education is what the Wright brothers knew about the space shuttle, what Henry Ford knew about suburban shopping malls.

Computers in education must be accepted and should be welcomed, controlled, and intelligently exploited. They are not intimidating and should not be surrendered to. Consider what computers can do. Quite arbitrarily, I shall discuss uses of computers under five headings: (1) games, (2) information systems, (3) drill machines, (4) creative tools, (5) interactive devices.

Games and Information Systems

I mention games simply because for many people this is a computer's most obvious and interesting function. From an educational point of view I regard this

function as true but irrelevant. There is nothing wrong with playing games on computers, but it is not their most enlightened or productive use. One interesting aspect of gaming on computers that will have some important educational implications is simulation. With a computer you can practise landing a jet plane without jeopardizing life or equipment, so realistically that even jet pilots learn on them. In such situations, of course, even aspects of language can be learned (like the jargon of air traffic controllers). It is tempting to think that simulations could provide rich opportunities for language learning and practice generally, but I do not see any necessity or advantage in this. For language learning, interaction with people for real purposes is better than participation in make-believe situations, no matter how compelling. And one of the greatest possibilities of computers, still largely unexploited, which I shall discuss in due course, is in bringing people together for language-using purposes.

I am similarly neutral about the educational potential of computers as information systems. Computers already constitute tremendous resources in the handling of information, in its acquisition, organization, storage and retrieval. But I do not see them taking the place of libraries, films or people in providing experience rather than information. And experience rather than information is the essence of language learning. Instead, computers can facilitate access to possibilities of experience with relevant books, films and people. If I need a telephone number it will be easier to have a computer look it up and dial it for me than to do all this myself. But if I want to enjoy a book, the most a computer can do is locate that book for me (at least until a computer display is as portable as a book). And if I am interested, say, in life in a particular country, an actual visit or a film will still be better alternatives to inspecting statistics or learning a set of facts.

Two aspects of the information management capacity of computers that many professional writers have found useful is in checking spelling and suggesting vocabulary. Teachers may well object to these facilities for the same reason that there were objections to typewriters and to hand-held calculators in classrooms, that they would make learning basic skills unnecessary and therefore interfere with learning. The reverse is probably true, certainly with respect to language. Difficulty with spelling or vocabulary improves neither spelling ability nor vocabulary size and interferes with composition. But anything that makes writing more fluent—that admits the learner into the club of writers—facilitates the learning of all aspects of writing.

Drill

It is as drill machines that computers are widely seen today as most relevant in education and where I think they are potentially most dangerous. Although uncertain or apprehensive teachers may be willing to hand over the task of constructing programs to experienced software developers, the repetitive presentation of simple questions where responses can be checked against *right* answers and results scored and stored for future comparison or report is in fact among the easiest kinds of computer program to write. Every bit of nonsense drill ever put on paper can be reproduced in computer software, and in living color as well.

I have listened to several TESOL convention discussions on the question of how computer software might be developed for second language instruction. The participants were TESOL experts. Most of the time they talked in terms of right and

wrong answers, correcting mistakes, tests and scores, the grist of programmed instruction and totally unrelated, as I have argued, to the way language is naturally used and learned. The discussants also talked frequently and cheerfully about language that would be distorted in some way, of texts in which blanks would occur for the student to complete, or with extraneous words for the student to remove—aberrations to be systematically or randomly produced by the computer, all highly ingenious in conception and application, and all totally unnatural. Whatever these experts were talking about, it was not language as it would be experienced in acutal use. They were thinking in terms of what could be done with the computer, fitting language to what they perceived as the possibilities and limitations of the machine and to the programmatic instructional situation it might command.

For anyone who thinks that learning must be measurable to be of value, especially in continual small quantities, or who thinks that what a drill can teach must be important, especially if packaged and promoted under the label of some important-sounding skill, computer-based instruction sounds enormously attractive. It is easy to impress teachers with such programs and to get children to attend to them. So much seems to be going on. Children find any kind of nonsense more palatable if presented in a *game* atmosphere, accompanied by an occasional happy face and the promise of ten minutes of Pacman. This is truly seduction of the innocent. One educational software company currently boasts in its advertizing that it can get children to attend to *learning* activities that would be too boring if presented in any other way.

On the other hand, children may not be so easily conned by superficially attractive aspects of educational software. A favored promotion phrase about many instructional programs is that they are *user friendly*, which means basically they talk to you conversationally and personally. But this is a trivially easy trick to program. Once told the student's name, the computer will patiently respond with personal little messages like "Well done, Nick, right again" or "Too bad, Nick, you got that one wrong." I thought this silicon intimacy was so transparent that I constructed a program to be user unfriendly. It said "At last you've got one right, you blockhead", or "Wrong again, you blathering idiot." And students loved it, children and adults.

Drill and kill can fatally damage both literacy and teaching. To anyone who holds that the development of language ability is a matter of learning basic skills through systematic instruction—and there seem to be many well-meaning but misguided people who have that belief—computers can not only do the job of teachers, but they can do it better. They can lead us faster all the way down the path to totally controlled programmatic language instruction.

The Creative Alternatives

If my approach to computers appears to have been cautious, if not downright negative, it is because I wanted to consider the dangers first. These are the most immediate. I think we know more about the dangers than about the possibilities, which is one reason so many people think computers should be kept out of language classrooms. Nevertheless I think every schoolchild should have easy access to computers, especially the youngest, especially in language education, because of the two other aspects of computer use I have yet to mention, their two most positive and favorable possibilities.

As a creative tool, consider what the word processor can do for writing. For a

start, it takes care of two of the greatest concerns of beginning writers and of all fluent writers—legibility and speed. Readability is always a problem for authors, even if not at the fetish level that neatness often becomes in classrooms. One touch of a computer keyboard and you have a perfectly formed letter which can be printed in a compact and properly aligned orientation. No need even to remember that in English, print goes from left to right. Typewriters offer the same advanages, of course, but at the cost of flexibility. It is difficult to erase or to write something between the lines with a typewriter and impossible to work vertically, or to draw arrows moving or connecting text in different parts of the page. But the word processor combines the speed and ease of the most sensitive electric typewriter with the maneuverability of a pencil on paper. Moving text around is a simple matter on a computer. Trying out something to see how it looks is easy, and so is retrieving what you did before. Working on two or more things at the same time is easy. Editing, correcting, revising, and retyping are literally child's play. This is power, control in the service of creativity, something that always grips children, what language and their brains inevitably seek. Word processors make writing a plastic art.

But few people have even begun to explore the power and possibilities that computers can offer all aspect of language use, in the way that Papert (1980) has explored what they can do for children's logical thought. To get even a feel of the future we must look at two other creative fields, music and art. For music, for a few hundred dollars, you can get a keyboard to connect to your computer. You can play three notes, and if you wish the computer will remember them for you and play them again, as often as you like. You would like to try three different notes? The computer will remember and play them. You prefer the first three? The computer will retrieve them. You would like to hear the six together? Repeatedly? In reverse order? Twice as fast? Transposed up or down a key? In waltztime? Syncopated? Counterpointed? Harmonized? With percussion? On the brass? Bring in the woodwinds? The ever-patient computer will do it all at the touch of a function key. And when you have put all the parts of your concerto together you can perform it on your digital stereo, make any changes you wish, and finally command the computer to print out the entire score for you. You can perform, conduct and revise your own composition as often as you like. None of the great classic composers could do that. That is the power of a computer for music.

For another few hundred dollars you can buy a graphics tablet to see what the computer will do for art. You draw a squiggle with a *pen*, and the squiggle appears on the screen. The touch of a key and the squiggle is erased. Another touch and it returns. You make it into a tree, and the computer will save it for you. You try to draw a cow to go under the tree, but fail. Did you draw a better cow yesterday? The computer will find it for you. Would you prefer to have the cow I drew? The computer will get it. The cow is too large? Touch a key and you can change its size. It is facing the wrong way? Touch a key and you can turn it round. You want a family of cows in descending order of size? In different colors? You want them to MOVE? You can't draw straight lines? Circles defeat you? No problem for the computer. It will even put a frame around the picture for you. No need to wait for paint to dry, or to repaint the entire secene to see how it looks in a different tone, in a different size, reversed, or in a different kind of frame. This is power once again—power to develop and fulfil the driving creative impulses of the human brain. No need to instruct a child in the desirability of such power. Rather adults must learn from children. I have seen artwork produced by six-year-olds with the help of computers that is equalled

in imaginativeness only by those two principal *adult* manifestations of computer art possibilities, record covers and television commercials.

What will the computer do for language, for thought? I have another analogy. I heard recently of young quadriplegics, victims of cerebal palsy who had been regarded almost as vegetables because of their inability to control movement, to communicate or to express themselves. They were provided with computerized keyboards representing a small number of symbols which they could activate in some way—poking at them with a toe, an elbow, or with a unicorn's horn strapped to the forehead. The technology exists today to activate a key simply by a glance, almost by an act of will, the way an artificial limb can be controlled by a muscle twitch. Once the possibility was opened for these formerly mute youngsters to enter the world of language users, they quickly exhausted the initial possibilities of the keyboard, demanded hundreds and even thousands of new symbols, invented their own meaningful combinations, and spent hours of their days and nights talking to each other. One of the staff told me how she suddenly realized that inside each of these clumsy, limited, inarticulate adolescents was a lively, intelligent, creative individual waiting to get out. Perhaps you think you know what computer technology can do for the physically handicapped. Here is a sobering thought. We are all physically handicapped. Within the limitations of our bodies, of our perceptual processes, of the fluency with which we have been able to speak, write and draw, there is an unimaginably lively, intelligent and creative individual, waiting to be released. What will computers do for language and thought?

How can we learn about the possibilities of computers? In what directions should we procede? There is no point in asking any adult in the world today. We all grew up in the BC era—before computers. Computers constitute a new culture. To live with them requires a new language. To understand them demands individuals without fear or preconceptions who can make sense of a new language, a new culture. Fortunately such individuals exist in large numbers of every generation. I am referring of course to children. The time has come in education when we must at last acknowledge that the greatest source of learning for teachers must be children.

Computers and Collaboration

A misconception prevails that computers are solitary and isolating devices—that a child working with a computer is somehow shut off from a real world and particularly from other people. Nothing is further from the case. Computers can dissolve the walls of classrooms, collapse space as well as time, and bring people together in dramatic new ways.

In writing, for example, two people can undertake joint authorship far easier than is possible with typewriters or even pencil and paper. No need for a collaborator to lean over a child's shoulder any more. No need to take something from someone in order to read it. I can show you what I am writing simply by reproducing my screen on your screen with a touch of a key. I can give you the contents of my memory (in computer terms at least). You can comment on what I have written, even make alterations to my drafts—while on my screen I observe what you do, as you do it. If your changes please me I can accept them, and if they do not my original text is not lost. Already the technology for this exists—though its possibilities are misunderstood. For example, one networking system designed for school use has a key that can be touched so that what is on the screen or in the memory of any other computer in the classroom can be inspected. A second key permits changes to be

made on any screen. And a third key, an override, can be used to prevent anyone else actually inspecting or changing what you have produced without your consent. Marvellous possibilities for collaboration—except that in the system as presented only the teacher would get the override key.

In second language instruction, children in English-speaking regions are laboriously drilled in French in the fond hope that one day they might be able to write a letter to a child in a French-speaking community. But already the technology exists for a child in Vancouver and a child in Quebec City to write a letter TOGETHER, collaborating on the text more closely than if they were sitting side by side with pencils and paper. Already, children in Fairbanks, Alaska, and in Frobisher Bay are conversing directly by computer.

We can all be closer in the future through computers. Readers will be closer to authors, writers to editors, learners to practitioners. I may not have to wait for my favorite author's next novel to be published. If the author consents, I will be able to read it as it is being written, truly making the author my collaborator as I vicariously write the story, sharing the excitement and frustration of composition and the discipline of revision and editing.

Of course there will still be a role for teachers, the same role that I have argued is the critical one for language teachers in any case, to demonstrate what language—and computers—can be used for, and to help children to use them themselves. The teacher's role will not be to instruct the child but to collaborate in activities which are mutually interesting and rewarding, where everyone learns because they share the same objectives, because they are members of the same club, even if their abilities differ.

Computers offer marvellous possibilities, still largely unexplored, but they must be used intelligently. Teachers, not computers, must be in charge of what goes on in the name of education, which means that teachers must understand computers and not be afraid of them. They are no more threatening than pianos.

Teachers themselves must learn about computers, if they are to help students to learn with them. This is not a choice that can be evaded. Fortunately, every teacher with access to a computer has an opportunity to learn, not by rushing off and taking a course in computer literacy, cramming oneself with the history of computers and the logic of Boolean algebra, but by taking the opportunity to learn WITH children. In most schools where computers are freely available to students today, students are the experts. Rigorous, time-consuming, programmed instruction is not required, only the opportunity to learn. As I have said, with computers teachers must be ready to acknowledge that education is a reciprocal activity, that the true teacher learns with the students.

My concern has not been about a theoretical issue. These are not basically philosophical, pedagogical or even practical matters that are under discussion. The issue, as I have said, is political. I have been talking about control. The question can no longer be evaded about who will make the decisions that determine how children learn, teachers working directly and collaboratively with children, or programmers pulling the strings from outside. If teachers and children are able to make use of the creative and interactive potentials of computers, then I believe we are on the threshold of a literate world scarcely imaginable. That is the alternative to the employment of computers in ways that will destroy literacy and teachers. And teachers are the critical people who must decide and and assert the way computers will be used in education.

We live in exciting times.

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